

REMARKS

The Office Action mailed December 29, 2004, has been carefully considered. Reconsideration in view of the following remarks is respectfully requested.

Pending Claims

Claims 21-40 are pending in this application.

Double Patenting Rejection

Claims 21-40 have been rejected pursuant to the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-13 of United States patent No. 6,705,845. With this response a Terminal Disclaimer signed by an attorney of record, David B. Ritchie, Reg. No. 31, 562, in compliance with CFR §1.321(c) is presented to obviate this rejection. A copy of the Oath/Declaration appointing Mr. Ritchie as Applicant's representation is enclosed herewith. Accordingly, this rejection is now moot.

The 35 U.S.C. § 103 Rejection

Claims 21, 23, 27 and 29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Loomans 3,695,788 in view of Myers 3,471,079.

Loomans discloses an apparatus for pumping fluids, which comprises a cylinder chamber and a first and second piston as well as an inlet port and an outlet port communicating with the cylinder chamber, and a drive mechanism for moving the pistons back and forth such that a width of a slit formed between the pistons varies during the back and forth movement.

There are important differences in the construction of the device OF Loomans and that of Applicant's Claim 21. With Loomans the cylinder chamber is a conventional tube. In the present invention a sleeve having a drill hole formed in it is provided. The drill hole has a very small diameter of the size of the order of only 0.2 mm. The pistons stick out at respective ends of the drill hole.

The first drill hole of the sleeve accommodating the pistons is sealed such that no liquid leaves the sleeve at its ends. With Loomans extra seals 28 and 29 are provided for the opposite ends of the sleeve (cylinder bore 14a) as shown in figures 1, 2 and 3. The seals are also visible in figure 4.

With the present invention as claimed in amended claim 21 the first sleeve and the two pistons are designed such that the first sleeve not only accommodates the pistons as with Loomans but provides the additional functionality that the first sleeve also seals the pistons without the need of providing extra seals. This additional functionality is achieved by a careful selection of the materials used for the first sleeve and the pistons. Loomans fails to disclose a sleeve consisting of hard metal or ceramic and pistons consisting of hard metal or tool steel. The combination of these materials ensures that on the one hand side the seal is sufficient and on the other hand side the friction between the sleeve and the pistons remains small enough. It must be kept in mind that the pistons are moved back and forth several thousand times per minute. Too high friction would result in unacceptable wear of the device.

In paragraph [0027] of the present application the following is disclosed: *With this embodiment, the drill hole 4 therefore also takes over the function of the sealing lips 11 of the first embodiment. The drill hole 4 and the corresponding piston 2 or 3 form a slot seal. In order to achieve a sufficiently tight seal, the sleeve 28 and the pistons 2 and 3 must be manufactured with high precision and from materials which suit each other. Good results were achieved when the pistons 2 and 3 and the sleeve 28 are each made of a hard metal or when the pistons 2 and 3 are made of tool steel and the sleeve 28 is made of ceramic. The radius of the drill hole 4 is manufactured with a value of $201\ \mu\text{m} \pm 0.5\ \mu\text{m}$, and the radius of the pistons 2 and 3 with a value of $200\ \mu\text{m} \pm 0.15\ \mu\text{m}$. Ideally, this results in a slot width of $1\ \mu\text{m}$. Suitable hard metals are, for example, WC (tungsten carbide), TiC (titanium carbide), TaC (tantalum carbide) or mixtures of these carbides which, mixed with Co (cobalt), have been sintered. Ceramic materials have the advantage of a higher abrasion resistance but the disadvantage of a lower thermal conductivity than hard metals.*

Myers discloses a piston made of steel or graphite steel or alumina material. Myers fails to disclose a piston made of a hard metal. The paragraph cited above lists several examples for hard metals that fulfill the needs to achieve the required properties of the seal. As explained

above the pump of Loomans is based on a construction that is completely different from the construction of the present pump. The same holds for the pump of Myers. These pumps are not suitable for the metered delivery of adhesives which contain flakes of silver as filling material.

At the time the invention was made no pump was existing in the market with the required properties, i.e. a pump suitable for mounting on a writing head for the application of adhesive onto a substrate which is to be equipped with a semiconductor chip. In this field the main problem is to place a precisely metered volume of adhesive on a semiconductor chip. With existing solutions a pump of considerable size is placed stationarily besides the writing head. The outlet of the pump is connected to the nozzle of the writing head by means of a hose. The pump is driven by pressure pulses that press the adhesive through the hose. However, a drawback is that the diameter of the hose is not stable within the required tolerances when the pressure pulses are applied so that the delivered volume of the adhesive is permanently subjected to small variations. The pump of the present invention is small and light and can be mounted directly on the writing head and the outlet of the pump can be formed as writing nozzle thus eliminating the problems caused by the hose. Furthermore with existing solutions pulses comprising a sequence of positive and negative pressure must be applied to start and stop pressing the adhesive through the hose in precisely metered amounts. This is a highly sophisticated technology. The invented solution with the two pistons that form a slit of varying width for repeatedly transporting small volumes of adhesive from the inlet chamber to the outlet chamber is much more reliable and robust with regard to the uniformity and constance of the delivered volume. The person skilled in the art of dispensing small amounts of adhesive onto a substrate and mounting a semiconductor chip thereon recognizes that the devices of Loomans and Myers are not suitable for his needs.

Neither Loomans nor Myers, considered singularly or in combination, render obvious the present invention, because the construction of their pumps is based on a tube or pipe as chamber accommodating the pistons and they do not teach a pump based on the inventive concept of using a sleeve with a drill hole for accommodating the two pistons wherein the sleeve guides and also seals the pistons with a slot seal.

For at least the reasons set forth above, the Examiner's rejection of Applicants' claim 21 under 35 U.S.C. §103(a) should be withdrawn and amended claim 21 allowed.

Claims 23, 27 and 29 depend directly or indirectly on amended claim 21. To support an obvious rejection of these claims, Loomans and Myers must teach or suggest all the limitations of the claims. As stated above in reference to Applicants' amended claim 21, Loomans and Myers do not teach or suggest all of the elements of amended claim 21. Thus, as claims 23, 27 and 29 depend from claim 21, for at least the above-identified reasons, Loomans and Myers do not teach or suggest all of the elements of Applicant's claims 23, 27 and 29.

With respect to claims 27 and 29, the cited prior art is completely silent. The prior art can therefore not contribute to this aspect of the invention.

For at least the reasons set forth above, the Examiner's rejection of Applicants' dependent claims 23, 27 and 29 under 35 U.S.C. §103(a) should be withdrawn and dependent claims 23, 27 and 29 allowed.

Claims 32, 34, 38 and 40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Loomans 3,695,788 in view of Myers 3,471,079 and further in view of Shim et al. 6,332,924.

Claims 32, 34, 38 and 40 depend directly or indirectly on amended claim 21. For at least the same reasons set forth above for claims 23, 27 and 29, the Examiner's rejection of Applicants' dependent claims under 35 U.S.C. §103(a) should be withdrawn and dependent claims 32, 34, 38 and 40 allowed.

Furthermore, Shim discloses a photoresist dispensing device, i.e. a device for applying a metered amount of photoresist on a wafer. This device does not contain a writing head, but only a nozzle for spraying the photoresist on the wafer. The nozzle is arranged stationarily and connected to a photoresist storage tank. In contrast to this the writing head of claims 32-40 is movably arranged and underlies high accelerations and decelerations (see paragraph 19 of the description). The writing head is used for the application of adhesive onto a substrate which is to be equipped with a semiconductor chip, i.e. as a dispenser on an apparatus for mounting semiconductor chips. From this follows that Loomans, Myers and Shim in combination do not teach all of the features of claims 32, 34, 38 and 40. For at least these reasons, the Examiner's

rejection of Applicants' dependent claims under 35 U.S.C. §103(a) should be withdrawn and dependent claims 32, 34, 38 and 40 allowed.

In view of the foregoing it is respectfully asserted that the claims are now in condition for allowance.


Request for Allowance

As each of the Examiner's rejections have been addressed herein, early favorable consideration of this Response is earnestly solicited and Applicants request that the Examiner enters this response and passes claims 21-40 to issue.

Please charge any additional required fee, including those necessary to obtain extensions of time to render timely the filing of the instant reply and those associated with the Terminal Disclaimer, or credit any overpayment not otherwise paid or credited, to our deposit account No. 50-1698.

Respectfully submitted,
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